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desired to thus draw off certain small ethnographic and monographic collections to call attention to any instructive peculiarities of any tribe or race. It also happens at times that large objects have to be left out of a comparative collection. In fact, any classification must be based on compromise and must yield to exceptions.

As an illustration of how we may show the development or evolution of any object with a widely scattered collection let us take the snow-shoe collection in the Museum. It is mounted on screens in the comparative style. If we had exhaustive collections from any one stock of Indians, say, we might show this development step by step (by the ethnographic method) from the time they borrowed or originated the idea up to its highest development, as shown. With the material at the Museum this evolution can only be suggested, as the steps are very wide, and intermediate ones are not at hand. We must in this adopt Mr. Spencer's plan of illustrating primitive man by our present savage tribe.

#### DISCUSSION.

Prof. MASON called attention to the advantages derived from a systematic classification and arrangement of the material in great collections like that of the Smithsonian Institution. He also said that an organized effort should be made looking toward a full utilization of the many resources afforded by the various departments of the Government for information valuable to the student of anthropology, and that the attention of the scientific world should be directed to the scope and character of these resources.

Mr. FLINT spoke of the manner in which aboriginal ideas had been followed up and finally developed, illustrating his remarks by showing how a study of the possibilities of the arrow as a projectile had resulted in its use for throwing explosives under a heavy air pressure, for which several patents have already issued.

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#### EIGHTIETH REGULAR MEETING, March 15, 1884.

Major J. W. POWELL, President, in the Chair.

The Secretary of the Council reported the election of the following-named gentlemen as corresponding members of the Society:

CHARLES C. ABBOTT, Trenton, N. J.

HENRY B. ADAMS, Baltimore, Md.

Rev. JOSEPH ANDERSON, Waterbury, Conn.  
Mr. H. H. BANCROFT, San Francisco, Cal.  
Mr. AD. F. BANDELIER, San Francisco, Cal.  
Dr. DANIEL G. BRINTON, Philadelphia, Pa.  
Mr. LUCIEN CARR, Cambridge, Mass.  
Mr. JOHN COLLETT, Indianapolis, Indiana.  
Mr. A. J. CONANT, St. Louis, Mo.  
Dr. GEORGE J. ENGELMANN, St. Louis, Mo.  
Prof. BASIL GILDERSLEEVE, Baltimore, Md.  
Mr. HORATIO HALE, Clinton, Ontario, Canada.  
Prof. G. STANLEY HALL, Baltimore, Md.  
Col. H. H. HILDER, St. Louis, Mo.  
Dr. C. C. JONES, Augusta, Ga.  
Rev. GEORGE A. LEAKIN, Baltimore, Md.  
Prof. E. S. MORSE, Salem, Mass.  
Prof. RAPHAEL PUMPELLY, Newport, R. I.  
Prof. F. W. PUTNAM, Cambridge, Mass.  
Col. CHARLES WHITTLESEY, Cleveland, O.  
Dr. DANIEL WILSON, Toronto, Canada.

Mr. H. H. BATES read a paper entitled "DISCONTINUITIES IN NATURE'S METHODS," of which the following is a synopsis:

The ingenious analogy drawn by Mr. Babbage, in the ninth Bridgewater treatise, from the operations of his calculating machine, to enforce an argument in favor of the conceivability of miracle, by bringing it under the domain of law, was cited as illustrating some of the discontinuities of evolution, confessedly the result of similar complexities of natural law.

The great discontinuity involved in the passage from inorganic to organic life, which we infer to have taken place under law, but do not understand, was adverted to. Also such apparent discontinuities as the passage from invertebrate to vertebrate life, or the introduction of mammalian life, from lower forms, with the observation that wherever nature seems to have carried specialization to its full extent and to have exhausted the possibilities of structure by mere differentiation she is found to have laid the foundation for a new differentiation, and a new specialization, with higher possibilities, from a different stem low down in the scale, constituting an apparent discontinuity, on account of the obscurity and feebleness and instability of the first unspecialized departures, by which they

were either unobserved or early obliterated through the operation of competition.

Passing over the wide domain of biology, which affords so many instances of this complexity of natural action, illustrations of the same law were sought in the domain of anthropology. The advent of man, and his means of progress, affords such examples. The development of the inventive faculty, as the distinguishing characteristic of mind, caused a modification of the old plan of progress by natural selection. Instead of being himself modified by nature, as hitherto, man began to act upon nature, both organic and inorganic, and to modify it to his needs, as Mr. Ward has pointed out. Henceforth natural selection affected only mental and ethnic qualities, through modification of nervous structure. Physical modification ceased to any important extent. Instead of developing weapons, man constructed extraneous ones for his use. With these he conquered competition and removed the rivals most cognate to himself. Militarism ensued, and resulted in high specialization.

Differentiation, however, soon reaches its highest results in this direction, and obstructs further progress. An apparent discontinuity occurred in the rise of industrialism out of the humbler elements of society, through the germination of inventions, beginning with the rediscovery of gunpowder, which was the commencement of the downfall of militarism. The tool-making and tool-using faculty came into prominence. Peaceful arts began to flourish, man's condition became ameliorated, and a new progress supervened. The new direction of evolutionary development was adverted to. Man, having ceased to evolve by physical selection, evolves by extraneous organs. Weapons and tools were the beginning of these, but he has also now enormously developed his means of locomotion, as well as his organs of special sense and expression. His eye is reinforced by the telescope and microscope and any optical device he needs; his ear by the telephone. The products of artistic industry furnish him with means for unlimited gratification of the æsthetic faculty in decoration. The culinary art relieves him from some of the burdens of digestion and increases his range of nutriment. All these extraneous means constitute a departure from the old law of development of the individual by selection.

Moral and ethical development have not made a parallel advance

since the dawn of history, on account of the lack hitherto of any discovery in that field commensurate with the important discoveries which modified his intellectual progress. Such a discovery would afford, by its results, an instance of a true and beneficent discontinuity. The necessity has always been recognized, and many theories broached which accomplished great temporary results, but failed of permanent fruit for want of confirmation.

The operation of discontinuities in the complex law of evolution is not always or necessarily beneficent. Nature is not optimistic, and discontinuities are known to have occurred which were disastrous and retrograde, as geological history evinces. Dissolution is involved in evolution.

#### DISCUSSION.

Mr. LESTER F. WARD said that he welcomed the term "discontinuity" in this new sense as supplying a need in biology. Its old use to denote actual breaks in the series and the special creation and fixity of species was no longer believed to express a scientific truth. But a special term was needed to designate certain apparent breaks which occur at irregular intervals both in the development of life and of society. Among these he enumerated the origin of life through the introduction of the substance protoplasm, the comparatively abrupt appearance of vertebrated animals which seem to have been developed from one of the lowest forms of invertebrate life, the equally radical change which resulted in the mammalian type, and the remarkable "short cut" by which man was reached through the lemurian and simian stem, leaving the other great branches, the *carnivora*, *ungulata*, etc., entirely out of his path. He had, in a paper read at a previous meeting, laid special stress upon the similarly sudden introduction of the developed brain of man, with its momentous consequences, as the first and greatest of this series of anthropic and sociologic strides to which Mr. Bates' paper was chiefly devoted.

In reply to remarks by Dr. Welling and Prof. Thomas inquiring how this kind of discontinuity was to be distinguished from the actual breaks postulated by the old school of biologists, Mr. Ward said that the reconciliation was effected through a recognition of the now well-established law of the ephemeral character of transition forms. The variations of structure which are destined to result in the dominant type take place at a point low down in the

scale. The first modified forms are few and feeble and leave no permanent record of their existence. The modifications required to give them a firm foothold take place with rapidity and the intermediate gradations are lost. The first evidence the investigator has that a new departure has taken place is the appearance of the more or less completely modified type, and it seems as though there had been a fresh act of creation, or *saltus*.

President WELLING said he would like to have Mr. Bates explain the precise sense in which he used the term "discontinuity" before conceding its necessity as an addition to scientific nomenclature. Without such explanation it would perhaps be held by many that the facts and principles recited in the essay were sufficiently covered by that law of succession, differentiation, and integration which the reflective mind of man had spelled out from the ongoings of nature. In these ongoings there had been constant *discontinuations* as well of processes as of products, but no *discontinuity*. If any actual discontinuity must be admitted then the whole doctrine of evolution, as commonly conceived, must fall to the ground, for that doctrine proceeds on the assumption of perpetual continuity amid perpetual discontinuations in natural processes. These perpetual discontinuations do but mark out the line of continuity along which nature has worked in the normal movement and projection of her processes and products. Discontinuations are matters of fact, but the principle which colligates them is *continuity*, not *discontinuity*.

In illustration of this point of view Mr. Welling then cited that latest and most stupendous evolution of man in society, known as international law. This law was built on the perpetual discontinuation of customs, practices, and institutions dating from the most primitive forms of social organization down to the present time, but none the less had it been built without the slightest lesion of continuity in the process of its evolution, for each successive differentiation in social and national relations had only paved the way for a new integration in thought and action.

Prof. THOMAS said that he agreed with Mr. Bates and Prof. Ward in believing that the term "discontinuity" was properly applied in speaking of some of the processes of nature. In following up the line of progress in the development of animal life we observed branches shooting out on either hand. For illustration, in passing from the higher Annuloida, Huxley's Scolecida, we are led by one

line, the Annulosa, to the Arthropoda, culminating in the higher insects. Here this branch appears to cease and is wholly separated from any of the higher forms of animal life. Here Prof. Thomas believed was a true discontinuity.

On the other hand, starting near the same point, was another branch embracing the mollusca.

The great vertebrate line, instead of originating from any of the higher forms of either of these branches, was supposed to arise directly or through a few transitional forms out of the Tunicata, the ascidian form.

There are many diverging branches, and as it appeared to be a law that no diverging line ever returned to the main stem or coalesced with another there must be discontinuities. No evolutionist can admit that there are any absolute gaps or breaks in the line of development, as this would be fatal to his theory. The line must be continuous or the theory must fall to the ground.

Mr. MASON said that phenomena might be associated in such groups as to be habitually observed together. Now, the mind being turned for a while toward one part of a group, returns to find a great change. There has been a discontinuity. Let us further illustrate. If we were studying Indian pottery, we should want to investigate the material, the implements, the agent, the process, the finished product, and the design, or final cause. Here are six sets of entirely different observations, the discontinuance of any one of which would produce an apparent discontinuity in the final result. The material might give out; it might be replaced by other material; new tools might be invented or imparted. The change of social order might throw the industry into other hands, as for instance, potters might become men instead of women. The introduction of varied processes, the multiplication of functions by the increase of wants would bring about the same result. The disconnections are apparent therefore, they are not real. In short, discontinuity anywhere either in natural or social phenomena is impossible.

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EIGHTY-FIRST REGULAR MEETING, April 1, 1884.

Dr. ROBERT FLETCHER, Vice-President, in the Chair.

The Secretary of the Council announced the election of the following members: